Evaluation of a protocol for same-day discharge after radial lounge monitoring in a southern Swiss referral percutaneous coronary intervention centre

Biasco, Luigi ; Pedrazzini, Giovanni B ; Araco, Marco ; Petracca, Francesco ; Del Monte, Daniele ; Sürder, Daniel ; Bomio, Fulvio ; Berto, Martina Boscolo ; Montrasio, Giulia ; Del Bufalo, Alessandro ; Pasotti, Elena ; Moccetti, Tiziano ; Moccetti, Marco

Abstract: AIMS: The aim of the study was to retrospectively evaluate safety and patient satisfaction of same-day discharge after elective radial coronary angiography/percutaneous coronary intervention (PCI) after the implementation of a radial lounge facility. METHODS: All patients admitted to our radial lounge with a planned same-day discharge after an uncomplicated coronary angiography/PCI, having a co-living caregiver, were day enrolled in the study. Rates of same-day discharge, unplanned overnight stay, and in-hospital and first complications [death, myocardial infarction (MI), unplanned coronary angiography, access site hematoma, bleedings requiring hospitalization] were analysed; satisfaction was also evaluated through a questionnaire. RESULTS: From February 2015 to January 2016, 312 patients with a mean age of 66.6 ± 10.8 years were admitted to the radial lounge (coronary angiography, n = 232; PCIs, n = 80). Of them, 245 (78.5%) were discharged the same day. Mean radial lounge monitoring was 6:35 h (interquartile range 5:30-7:30 h). No episodes of death/MI/unplanned coronary angiography were observed both in same-day discharged and postponed patients. Reasons to postpone discharge were: PCI deemed to need prolonged monitoring in 31, patient's preference in 14, femoral shift in 13, surgery in four, chest pain in four, and bleeding in one. At day 1, 11 access site hematoma and one hospitalization for access site bleeding were reported. Patients reported complete satisfaction in 97% of cases. Unplanned overnight stay was common among PCIs patients (RR 6.2, 95% CI 3.9-9.9, P < 0.001). CONCLUSION: A low rate of minor complications was observed in elective radial coronary angiography and PCIs showing the feasibility and safety of the development of an institutional protocol for same-day discharge after the implementation of a radial lounge facility.

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Conclusion **A low rate of minor complications was observed in elective radial coronary angiography and PCIs showing the feasibility and safety of the development of an institutional protocol for same-day discharge after the implementation of a radial lounge facility.**

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Keywords: coronary angiographies, radial access, radial lounge, same-day discharge

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Introduction

Despite being widely described as well tolerated, effective and cost-saving, same-day discharge[1] of selected, elective, radial patients evaluated with coronary angiography or treated with percutaneous coronary intervention (PCI) still meets some substantial friction in its implementation as a standard clinical routine.[2] Scepticism is supported by the latent harm of a medically unattended home overnight stay with the risk of vascular access complications, or by the rare, but potentially lethal, risk of acute stent thrombosis.[2]

Nonetheless, modern organization of patients' flow through hub healthcare providers should aim to offer the best treatments at the lowest risks and costs, coping with the optimization of patient's satisfaction. This concept ultimately moves the focus onto who are the patients eligible for a well tolerated discharge a few hours after an invasive procedure, rather than whether same-day discharge is an option.

Implementation of a radial lounge facility at our institution – a dedicated area to host and monitor radial patients – prompted the need for the development of an institutionally based protocol for same-day discharge that could fit the need of our institution, of the network of referring centres and of the population of our community.

Thus, the aim of this study is to report the validation process of our institutional protocol for same-day discharge for radial coronary angiography/PCI patients and to describe our experience after the implementation of a radial lounge facility, providing a reference for the development of local protocols.

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Methods

An institutional procedure for patient selection, monitoring and continuous evaluation of early discharge safety was developed based on experiences available in literature.[3] It was then modified according to the requirements of our institution, Cardiocentro Ticino, a single referral hub for interventional cardiology and cardiac surgery for the whole Italian-speaking part of Switzerland, covering a resident population of more than 350 000 inhabitants and more than 80 000 foreign commuters. The radial lounge protocol has been shared and approved by the medical steering committee of our institution.

Pre-procedural patient selection

All elective patients were admitted to our institution the same morning of the procedure and pre-screened for same-day discharge suitability.

A pre-specified set of patient characteristics was selected *a priori* and shared with medical/paramedical personnel admitting patients. Criteria evaluated at admission are as follows:

(1) stable hemodynamic conditions (no signs of overt or upcoming cardiac failure or haemodynamically significant cardiac arrhythmia);
(2) elective setting (thus acute coronary syndromes with or without ST-segment elevation excluded);
(3) patient willing to be same-day discharged;
(4) presence of a valid co-living caregiver;
(5) living within 45 min away from the hospital;
(6) good renal function [estimated glomerular filtration rate (eGFR)$>$ 45 ml/min/1.73 m^2];
(7) radial access planned.

Patients fulfilling all the above mentioned criteria were considered to be potentially suitable for same-day discharge. This was subsequently checked and confirmed throughout the whole hospital stay. Each referring physician was asked to provide a definite set of laboratory test, performed within 3 months. When missing, laboratory tests were obtained at admission and procedure was performed until validation was gained.

Procedural parameters

Irrespective of the type of procedure, whether diagnostic or PCI, even in the case of multi-vessel PCI with multiple stents (chronic total occlusions excluded per protocol), all patients considered suitable for same-day discharge were then confirmed as such after the procedure, if fulfilling the following criteria:

(1) procedure completely performed through the radial access with a 5–6-French hydrophilic sheath (femoral shift not allowed);
(2) absence of procedural complications, namely: unresolved arterial dissections, slow/no flow phenomena, final deterioration of TIMI flow in target vessel, artery perforation, need for pericardiocentesis, need for intra-procedural inotropic/mechanical support, arrhythmias requiring intervention;
(3) absence of evident access vessel complications, namely: clinically significant access site hematoma, overt bleeding, access vessel dissection/perforation;
(4) absence of neurological complications.

Use of GP IIb/IIIa inhibitors was allowed as a bailout strategy at discretion of the operators, and by definition same-day discharge was not allowed. During diagnostic angiography the average dose of heparin administrated was between 3000 and 5000 International Units, in relationship with procedure's length, patient weight and co-existing comorbidities. When the diagnostic angiography is followed by PCI, loading dose with any P2Y12 inhibitors is administered before wiring the lesions or at the end of the procedure at discretion of the performing physician. Moreover, a cut-off for contrast dye utilization was not set for patients with normal renal function; in those with a reduced GFR (between 60 and 45 ml/min/1.73 m^2), decision on suitability for discharge was left to operator's discretion

At this stage, a certain number of initially unplanned patients, nonetheless fulfilling both pre and post-procedural criteria, were deemed suitable for same-day discharge, thus referred for monitoring in the radial lounge.

Radial lounge

Radial lounge is a dedicated facility able to host up to six patients in individual bays, each equipped with a 'business class like seat', with a multi-parametric, wireless monitor allowing continuous ECG and blood pressure measurements, fully equipped for standard or emergency situations, such as intravenous infusions or cardiac resuscitation. Apart from this, each bay is also equipped with a patient's dedicated tablet for entertainment or medical education purposes through apps and tutoring videos, along with phone access and Wi-Fi connection.

All bays are continuously monitored and assisted from a back-staying team of two trained nurses. Standard medical equipment, and also emergency devices such as external defibrillators, suction and ventilation supplies are stored and readily available in a partitioned, adjacent, resuscitation room (Fig. 1).

Per protocol, as soon as admitted to the radial lounge, all patients were evaluated with a 12-lead ECG. When PCI was performed, cardiac biomarkers (troponin I, creatinkinase, creatinkinase-MB) 6 h after the procedure were obtained.

They were allowed to be fed not earlier than 30 min after the procedure; nonetheless, all were requested to be able to drink before leaving the hospital.

Fig. 1

Panel a: panoramic view of the radial lounge at Cardiocentro Ticino; panel b: overview of the individual bays; panel c: three-dimensional rendering of the radial lounge and panel d: patient bay.

Monitoring in the radial lounge should not last less than 6 h; thus, to allow discharge not later than 8 p.m., admissions were authorized until 2 p.m. and then closed.

One hour before planned discharge, an additional ECG was recorded in all patients (whether they underwent diagnostic only procedures or not). Furthermore, a full set of blood samples to measure blood cell count, electrolytes, renal function and cardiac biomarkers was also collected at the operator's discretion (usually when PCI was performed or dye amount exceeded 200 ml).

Only patients with the following characteristics were effectively discharged:

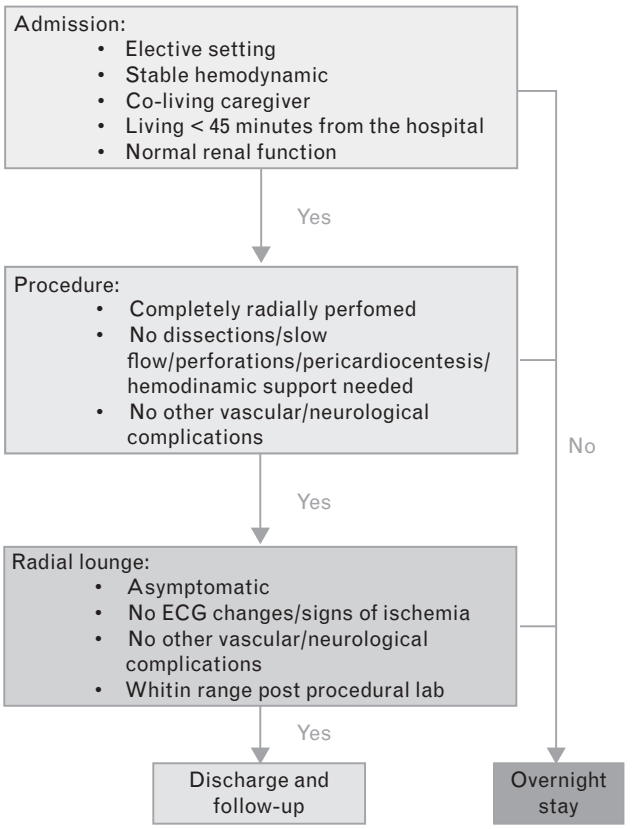
(1) stable haemodynamics;
(2) no recurrent chest pain or ECG signs of ongoing ischemia;
(3) no significant haemoglobin drop, signs of renal failure or any rise of cardiac biomarkers (even if less than the commonly used limit of 2.5 times the the upper limit of normality value).

Before discharge, clear indications about performed examination, prescribed medical therapy, prevention of access site complications and acute management in case of bleeding were given to all patients. A 24-h phone number for emergencies was also provided, and a follow-up phone call announced. An overview of our institutional protocol is provided in Fig. 2.

Early complications were ascertained for each patient effectively discharged the same day, through a follow-up phone call performed within 24–72 h. Whenever a complication was reported or suspected at follow-up, the patient was scheduled for an outpatient visit on the same day. Patient satisfaction was also evaluated through a five-grade questionnaire.

In order to assess the safety of this approach, we retrospectively analysed our on-site registry, collecting all intra-procedural and in-hospital complications (death, MI, unplanned interventions, access site bleeding) in patients undergoing an elective coronary angiography or PCI during 10 months before the implementation of

Fig. 2



Flow chart of the institutional protocol for same-day discharge.

the radial lounge. The composite complications' amount resulted to be 5‰. An a priori complication rate equal or lower than 5‰ was then set as the endpoint to test the safety and efficacy of our protocol for early discharge.

Results

Between 1 April 2015 and 31 January 2016, a total of 312 patients were admitted to the radial lounge after an uncomplicated radial procedure. Two hundred forty-five patients out of 312 were same-day discharged, after a median monitoring of 6 h and 35 min. A detailed description of their baseline characteristics is provided in Table 1, whereas Fig. 3 provides a description of patients' flow.

The vast majority of patients screened for same-day discharge were referred to invasive evaluations due to suspected but not previously known ischemic heart disease. Among those patients, one out of three was effectively treated with PCI through radial access. During the study period, a progressive increase in the proportion between PCI patients and those evaluated with pure diagnostic coronary angiographies was observed, reaching a 1 : 4 ratio during the last 30 days of observation.

None of the patients undergoing pure diagnostic coronary angiographies had serious procedural complications; thus,

Table 1 Patient characteristics

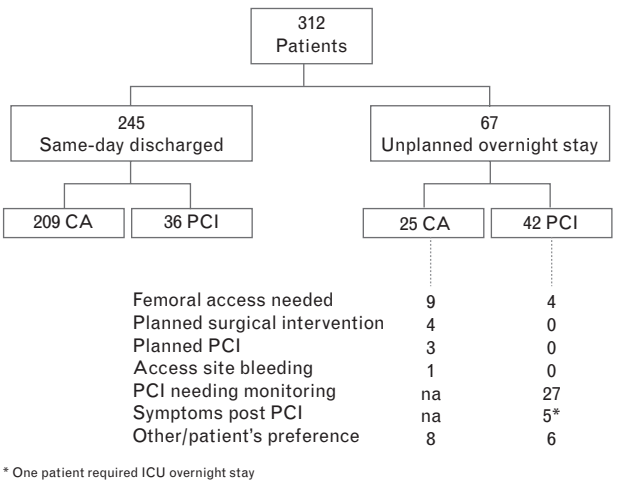
Number of patients	312
Male sex, n (%)	205 (65.7)
Age, years	66.6 ± 10.8
Indication	
Diagnostic CA, n (%)	242 (77.5)
CA in known CAD, n (%)	60 (19.2)
CA in known CAD + previous CABG, n (%)	10 (3.3)
Procedure	
CA only, n (%)	234 (75.0)
CA and PCI, n (%)	78 (25.0)
Single-vessel PCI, n (%)	54 (17.3)
Multi-vessel PCI, n (%)	24 (7.7)
Mean procedural time, min	47.1 ± 30.6
Mean contrast used, ml	184.0 ± 102.3
Radial lounge	
Median monitoring	6 h 35 min
Interquartile range	5h 30 min-7h 30 min
Same-day discharged, n (%)	245 (78.5)
Diagnostic CA, n (%)	209 (66.9)
PCI, n (%)	36 (11.5)

CA, coronary angiography; PCI, percutaneous coronary intervention; CAD, coronary artery disease; CABG, coronary artery by-pass graft.

in these cases, an unplanned overnight stay was due to need for a femoral shift in nine, early surgical intervention in four, complex staged PCI in three, and patient preference in eight. One patient, showing a mild oozing from the radial access, managed with prolonged radial compression, was monitored overnight for safety reasons.

Unplanned overnight stay was common among PCIs patients (relative risk 6.2, 95% confidence interval 3.9–9–9, $P < 0.001$). In the vast majority of them, even in the absence of symptoms or procedural complications, overnight stay was advised to prolong clinical monitoring in 27 patients, whereas only five were kept in hospital due to recurrent symptoms after PCI (one requiring intensive care unit admission). Six patients declined same-day discharge after an uncomplicated PCI procedure.

Fig. 3



* One patient required ICU overnight stay

Flow chart reporting final allocation of patients admitted to the radial lounge.

Interestingly, none of those 27 patients in whom observation was prolonged to the following day needed any unplanned intervention or developed any early complication. In the vast majority of them, a postponed discharge was due to late re-entry from the cardiac cath laboratory (i.e. later than 2 p.m.), not allowing same-day discharge after adequate monitoring, or in case of elderly patients in whom overnight hospital stay was deemed necessary.

Among 245 patients who were effectively discharged, no major adverse events (death, MI, stroke, unplanned interventions) were evident at the follow-up phone call obtained within 24–72 h from discharge. Five patients reported access site hematoma, whereas three complained of pain at the site of vascular access, none limiting daily life activities. Only one patient was newly referred from his general practitioner 24 h after discharge due to a moderate oozing from the radial artery, which was managed with compression. Clinical observation up to 24 h was advised, mainly for safety reasons. Thus, the overall complication rate observed during the study period was 1/245 (4‰).

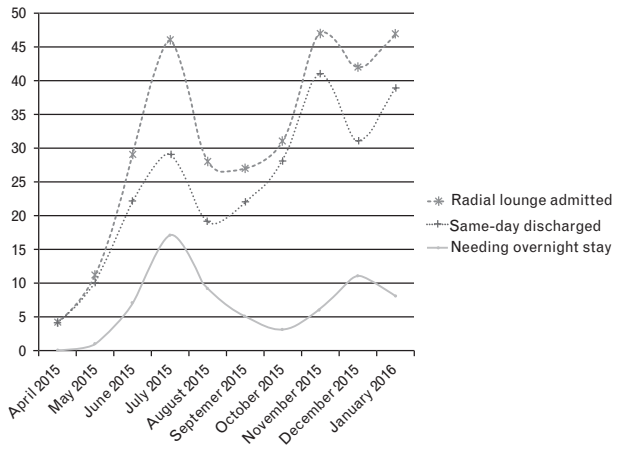
During phone follow-up, apart from clinical information, patient satisfaction was also evaluated through a five-grade questionnaire. More than 95% of evaluated patients reported complete satisfaction after radial lounge stay and same-day discharge, whereas only three reported discomfort during radial lounge stay with preference for standard rooms.

Discussion

Major findings of this study are as follows:

(1) Our institutional protocol for same-day discharge revealed to be well tolerated and effective in the management of patients scheduled for coronary angiography or uncomplicated elective PCI, with a complication rate of 1/245 (4‰), lower than the prespecified limit set at 5‰.
(2) Implementation of a radial lounge and same-day discharge protocol met patients' expectations and was perceived as comfortable and satisfactory.
(3) An operator's 'learning curve' effect was observed in the initial period after the implementation of the radial lounge, with a progressive increase of patients referred for monitoring and same-day discharge (Fig. 4). This was evident not only for coronary angiographies but also in patients treated with PCIs, with a progressive increase in the proportion of patients effectively treated with angioplasties throughout the study period.
(4) When overnight stay was deemed necessary after PCI, no complications were observed at prolonged monitoring.

Fig. 4



Monthly trends of radial lounge use during the study period.

Modern interventional cardiology has assisted in the past 30 years to an incredible evolution of techniques and technologies that nowadays allow the safe performance of procedures that, only a few years ago, were considered close to surgery. One of the major acquisitions is the shift from a femoral access to a radial one, that even if still debated has gained common acceptance among most centres. This, together with the optimization of antiplatelet[4] agents and advances in stents technology, reduced the rate of acute severe complications such as vascular access bleeding and acute stent thrombosis, questioning the need for a long hospital stay after uncomplicated PCI. Whereas pioneer studies by Kiemeneij *et al.* published back in 1994 basically proved the feasibility of this approach,[5–8] nowadays there are still residual frictions in the implementation of a same-day approach in clinical practice, mostly based on concerns about patient safety, lack of training in new vascular approaches, lack of settings able to guarantee a safe in hospital monitoring, an efficient early feedback after discharge or a fast re admission in case of adverse events.

Modern organization of healthcare providers should aim to maximize patients' outcomes, safety and perceived quality, together with an optimal allocation of economical resources. From a patient's perspective, a short hospital stay for a diagnostic or even a therapeutic intervention is something desirable, in order to avoid a long interruption of personal or professional daily life activities.

This is not only desirable from young patients' point of view, professionally and physically active, willing to return rapidly to their daily life activities, but also beneficial for elderly patients, protecting them against the potential harms related to hospitalization, such as long bed stay, falls or delirium.[9]

A very short hospital stay in elective patients is also attractive from the healthcare provider's perspective for several reasons.

Efficient utilization of beds, especially when reimbursements for elective examinations are fixed independently from duration of hospital stay, is a way to optimize allocation of economical resources. Moreover, in the past decade, structural interventional procedures are gaining a prime role with the need to allocate more and more beds to those more complex patients. As evident from our data, after an initial run-in period, operators start to build up their confidence, referring patients to radial lounge for same-day discharge. The results of this retrospective analysis confirm the safety of this approach, supporting an extended use of this strategy.

Nonetheless, implementing a well tolerated and efficient protocol for same-day discharge should not only modify conventional routines in terms of time effectively spent in hospital but also prompt a complete re-evaluation of patients' flow through healthcare facilities, through the organization of both medical and administrative work and the development of a dedicated facility where patients can safely, effectively and comfortably spend their time during hospitalization.

In our experience, the implementation of a radial lounge was considered to be the optimal setting to achieve several goals.

First of all, close patient monitoring was obtained during the early hours after an invasive procedure, known to be those at the highest risk of possible complications.[2] This early monitoring is somehow even more accurate when compared with the standard of care, having a nurse a few steps away from the patient for the whole time spent in the radial lounge.

As a second issue, one of the risks of a short hospital stay is indeed the lack of appropriate patient education and awareness of their health status, which could induce patients to underestimate their medical condition. Therefore, all medical professionals were trained to provide patients with comprehensive information about their health status, the procedure itself, its benefits and potential complications, and also full information about discharge medical treatment, in order to educate the patients on their current disease and to supply them with recommendations about primary and secondary cardiovascular prevention.

As a third point, the radial lounge setting met patients' will, as clearly demonstrated by their reported satisfaction.

In conclusion, this analysis shows the feasibility and the safety of the development of an internal protocol for radial lounge monitoring and same-day discharge in coronary angiography/PCI patients, highlighting the crucial role of patient selection and early monitoring in order to avoid early post-discharge adverse events.

Acknowledgement

There are no conflicts of interest.

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